

ESAVE

Environmental Stewardship & Value Engineering

Quarterly Newsletter for the United States Department of Energy,
National Nuclear Security Administration



Sandia National Laboratories earns DOE P2 Award for 'building green'

Architects, engineers, and construction personnel at Sandia National Laboratories are working to integrate sustainable design into new and renovated facilities. Four new projects at Sandia (one completed, one under construction, and two in planning phases) illustrate the labs' commitment to "building green."

Sandia uses a team approach to building design that addresses the needs of the building occupants and involves a collaborative effort between several of the labs' programs, including energy management, water conservation, pollution prevention, project management, systems engineering, architecture, and inspections. This "Green Team's" efforts have earned a 2002 Department of Energy (DOE) Pollution Prevention Award for "Sowing the Seeds for Change."

Sandia has incorporated sustainable design into the creation of a "green" conference room in the Weapons System Engineering Building, renovation of the Model Validation Building, and planning for the Joint Computational Engineering Laboratory (JCEL) and the Microsystems and Engineering Sciences Applications (MESA) complex. Sandia is also revising its *Construction Specifications and Design Manual* to ensure that sustainable design is routinely included in future construction efforts.

Materials selection in the green conference room demonstrates Sandia's emphasis on sustainable design. The room's wear-resistant carpet is 25 percent reclaimed nylon with 100 percent recycled backing and was installed with non-toxic, non-emissive chemicals; noise-dampening natural wall covering is made from organically farmed agave plants. Costs for both carpet and wall covering were 30 to 50 percent below those of standard, less environmentally friendly materials. New, sustainably manufactured ceiling tiles contain 70 percent recycled materials and are 100 percent recyclable. An energy-efficient lighting system reduces energy consumption and costs. Old ceiling tiles, light fixtures, and electronic equipment removed during the remodeling are being reused at Sandia or other government facilities.



Artist's rendering of the Joint Computational Engineering Laboratory, now in the planning phase at Sandia National Laboratories in New Mexico.

For the 18,600 square-foot Model Validation Building renovation currently under way in the high desert on the edge of Technical Area 3, Sandia's Green Team brainstormed with consultants and a cross-section of project stakeholders in a 2-day, rigorous planning meeting. Seventy percent of the basic structure of the original building is being reused in the new building, while site disturbance is limited to preserve existing vegetation; vegetation damaged by construction activities will be restored. Drought-tolerant native landscaping will reduce water consumption. Outside lighting will consist of minimum wattage lamps on articulating arms that help direct the lighting at the building, reducing night sky pollution.

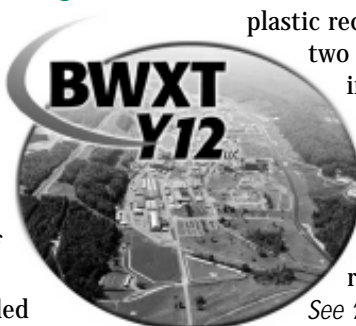
Carpool and bicycle spaces are being integrated into parking areas and there will be a centrally located recycling center. An energy efficient lighting system that requires no more than 1 watt per square foot will reduce cooling needs, and sensors will

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Analytical Chemistry employees take the initiative in P2 at Y-12

The BWXT Y-12 National Security Complex's Analytical Chemistry Organization (AC), which provides support to Y-12 operations from two large laboratories, has a long history of pollution prevention successes. Pollution prevention is truly integrated into daily operations within AC—laboratory personnel routinely identify and implement pollution prevention projects as part of their jobs.

AC pollution prevention projects for 2001 included



plastic recycling, solvent dispensing stations, establishment of two Non-Radiological Materials Management Areas, and implementation of PCB regulations. Projects that demonstrate AC's commitment to source reduction involve environmentally preferable product substitution and the use of disposable centrifuge tubes.

The product substitution involved finding an environmentally safe cleaning product to remove residue remaining on AC laboratory glass and plastic

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ware after it was put through a dishwasher. AC identified A-to-Z Plus™ cleaner as a suitable replacement for the effective but hazardous nitric acid that was previously used for residue removal.

The substitute cleaner reduced safety concerns and hazardous waste management costs, eliminated the need for nitric acid in the cleaning process and the use of sodium hydroxide to neutralize the nitric acid, and reduced the time required by a laboratory analyst to clean the glassware, neutralize the acid waste generated by the cleaning process, and verify that the glass and plastic ware are free of residue. A-to-Z Plus has since replaced an all-purpose cleaner previously used for clean-up of lab hoods and surfaces and for soaking the reusable tweezers that are used to handle sample filters. AC also exchanged its dishwasher soap for lower-cost, low-sudsing EarthSafe™ cleaner.

In another source reduction project, employees implemented the use of disposable centrifuge tubes to reduce radiological "smear" waste. Workers in the AC radiochemistry laboratory routinely analyze smear samples brought to them by Y-12 radiological contamination (RADCON) technicians. Traditionally, samples were delivered in small, wax-coated bags. Lab personnel would remove the smear sample from the bag, process the sample in a furnace, digest the ash in a beaker with nitric acid, dilute the sample in a bottle, and then analyze the sample for the requested radionuclides. This process required a significant amount of time and material and used relatively large quantities of nitric acid.

The AC laboratory worked with RADCON to substitute disposable centrifuge tubes for the wax-coated bags as smear containers. Lab personnel use the sample tube itself as a digestion vessel that is then heated in a microwave oven, a process that is more efficient and reduces the amount of nitric acid used in the radiological analysis.

From 1995 through 2000, AC completed 15 distinct pollution prevention activities, reducing more than 306,000 kilograms of waste with a savings/avoidance of more than \$1.4 million, at a cost of approximately \$352,000. During 2001 alone, AC's seven completed pollution prevention activities reduced more than 46,000 kilograms of waste, avoiding more than \$700,000 in waste management costs, for a total investment of about \$90,000.



Ann Likens of Y-12 Analytical Chemistry places a sample for radiological analysis in a centrifuge rack for digesting in a microwave. Y-12 RADCON personnel place smear samples directly into the disposable centrifuge tubes to streamline analysis and eliminate waste.

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dim lights when sufficient daylight is available and turn off lights when spaces are unoccupied for a given period.

The Model Validation Building's various heating, ventilating and air conditioning system motors will adjust fan and pump speeds to deliver just the amounts needed, reducing motor-operating costs by 30 to 60 percent annually. Energy efficiency measures will provide an estimated 30 percent overall energy reduction over a conventionally designed building.

Workers have recycled more than 65 percent of all construction debris (656 tons) and reclaimed for reuse more than 200 items such as sinks and hardware from the old building. New construction materials were selected for local availability, renewability, and recyclability, while 20 to 50 percent of the material recovered during renovation will be reused in the reconstruction.

Two large new projects, the 60,000-square-foot JCEL and the 377,000-square-foot MESA complex, both part of Sandia's efforts to develop advanced tools for a science-based weapons stockpile stewardship program and both slated to be built in the southeast corner of Technical Area 1, are currently in the design stage. Each of these projects will be submitted for certification as a "Green Building" by the U.S. Green Building Council.

The JCEL project incorporates sustainable design elements similar to those in the Model Validation Building: harvesting roof rainwater, retaining runoff for landscaping needs, maximizing daylighting, and integrating high-efficiency lighting. Builders are selecting environmentally friendly materials and meeting high levels of efficiency for the structure's heating and cooling systems.

The MESA project is a mammoth, multi-building complex projected to have a \$1.9 million annual energy cost and consume up to 220 million gallons of water annually without conservation measures. Advanced efficiency requirements in the design criteria are expected to reduce energy and water consumption by as much as 30 percent compared to existing Sandia facilities.

"Water is scarce in many areas. It's a precious commodity," said Don Cook, director of the MESA Project. "If we can save it here, it can be saved in other microelectronics fabrication plants, which are notorious for high water use. We will not only be good neighbors to the people of Albuquerque, we will contribute to the preservation of the ecology in any areas where a microfabrication plant exists."

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LANL begins biodiesel fuel testing

The U.S. Department of Energy's Los Alamos National Laboratory (LANL) and Johnson Controls Northern New Mexico are working to obtain biodiesel fuel for diesel engines on site. The Laboratory will obtain a blend of 20 percent biodiesel and 80 percent regular diesel (B20). The first tests are with soybean-derived fuels in a forklift and a diesel powered generator. With successful test results, the Laboratory's diesel vendor will provide B20 through the existing contract for diesel fuel. This effort will help the Laboratory meet Federal goals of purchasing bio-based products, reducing emissions and increasing the use of alternative fueled vehicles.

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Helping lead the way to a cleaner future

Fuel cells for cars get independent evaluation at Argonne



Argonne National Laboratory's Fuel Cell Test Facility recently completed testing of this 50 kW gasoline-powered fuel cell system, which manages its own gasoline, air, and water. It was developed for the Department of Energy's Fuel Cells for Transportation Program, where Nancy Garland (shown here) is a project manager.

Fuel cells are rugged, solid-state devices that convert chemical energy into electricity very efficiently. They emit very little pollution, which makes them particularly appealing for automotive applications. Fuel cell developers, fuel cell users, automakers, and government and private agencies all need some way to obtain an unbiased assessment of the fuel cell technologies currently being developed for transportation.

Argonne National Laboratory's Fuel Cell Testing Facility can fill that bill, providing independent, standardized testing and evaluation. The Facility, established by the Department of Energy's Office of Advanced Automotive Technologies, has evaluated various fuel cells on behalf of different government and private organizations.

The Facility draws on Argonne's extensive experience evaluating batteries and battery test equipment, and provides the same high-quality testing for fuel cells. Equipped with extensive and specialized hardware and computing power, the Facility is ideally suited to the complex task of testing fuel cell systems, including how well fuel cell stacks and supporting components interact. The Facility provides a standard test environment for benchmarking new fuel cell stacks and systems. Since the

evaluations are independent as well as standardized, the test results help validate the capabilities of a particular fuel cell technology and allow for its direct comparison with competing fuel cell technologies.

The Fuel Cell Test Facility has been specifically designed to automotive power criteria. It is equipped to test fuel cell stacks and systems up to 80 kW, the size needed for a passenger car. The brain of the facility is a computer-controlled electronic load system that can simulate the power demands of a vehicle. The heart of the facility is a sophisticated gas management system that supplies air and fuel to the fuel cell with precise control of flow rate, pressure, temperature, and humidity. The fuel can be hydrogen, gasoline or simulated reformat. (Reformat is the output gas of a device that produces hydrogen from other fuels, such as methanol, gasoline, or natural gas.)

In addition to Argonne's versatile battery test equipment, the Facility uses a custom-designed, state-of-the-art fuel and gas management system. The system controls the temperature, pressure, humidity, and flow rate of both fuel and air and can simulate the rapid gas-flow changes found in actual driving conditions, as cars accelerate and brake.

Most recently, Argonne's Fuel Cell Test Facility has begun testing fully integrated fuel cell systems that incorporate their own fuel processing and air supply sub-systems. The Facility recently finished testing a 50 kW gasoline-powered fuel cell



An automotive-scale fuel cell gets a thorough examination by Tim Stoinski of Argonne's Fuel Cell Test Facility.

system that manages its own gasoline, air, and water. The system was built by UTC Fuel Cells for the U.S. Department of Energy's Fuel Cells for Transportation Program, under a project managed by Patrick Davis. The Fuel Cells for Transportation Program is focusing research on reducing the size, weight, and cost of current fuel cell systems to meet requirements for automobiles.

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NREL lands Xcel renewable energy contracts

The U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) has been selected to perform three research projects, worth \$2.8 million, as part of a program to advance renewable energy funded by Xcel Energy's Renewable Development Fund.

One project is to develop a filter that can remove potential pollutants from systems that produce energy from biomass. NREL will manage that \$639,000 contract, with subcontractors Community Power Corp. of Littleton, Colo., and MagStar Technologies of Hopkins, Minn. A second project is for \$935,000 in

NREL research on a solid state Titania solar cell. A third, \$1.1 million contract through the Colorado School of Mines, is to develop new electrocatalysts for proton exchange membrane fuel cells.

"Our national lab is pleased to have this opportunity to work with Xcel, the Colorado School of Mines, and innovative research and development companies in these important endeavors," said Stan Bull, NREL associate director.

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Pacific Northwest National Laboratory rescues LLW refrigerators



Ray Clayton of Pacific Northwest National Laboratory is shown with low-level contaminated refrigerators destined for use at the Environmental Science Laboratory at Pacific Northwest.

What to do with 10 double-door refrigerators contaminated with low-level radioactive waste? The Pacific Northwest National Laboratory to the rescue.

Pacific Northwest had acquired more soil samples needing refrigeration than it had refrigerators, in support of the Single-Shell Tank Farm Vadose Zone Project, managed by CH2M Hill Hanford Group Inc. Across the Hanford Site to the north, the 222-S Laboratory, operated by Fluor Hanford Inc., had 10 double-door refrigerators they planned to dispose of.

Often, two such disparate organizations would not know of each other's plight. Enter Ray Clayton at Pacific Northwest to play matchmaker—and avoid well over \$58,000 in procurement costs, not to mention thousands in disposal costs.

The 222-S Laboratory supports waste management and characterization projects in an area of the Hanford Site where plutonium was formerly chemically separated out from irradiated fuel and where now the U.S. Department of Energy is cleaning up the waste from that process. The 222-S Laboratory had used the refrigerators to store environmental samples but no longer needed them. Because of the location, Fluor Hanford had to treat the refrigerators as potentially radioactive, which would mean significant disposal costs.

In its Environmental Sciences Laboratory, Pacific Northwest is currently analyzing soil samples from the vadose zone around, and in one case directly beneath, single-shell tanks. Given the past history of single-shell tanks leaking, CH2M Hill, with support from Pacific Northwest, launched an aggressive campaign to understand the fate and transport of high-risk contaminants.

The result is a substantial accumulation of highly contaminated sediment samples and with it the need for more refrigerated storage space—namely 10 double-door refrigerators with a total price tag of \$58,000.

Once Ray Clayton ferreted out the 222-S Laboratory refrigerators and found they matched Pacific Northwest's needs, he then faced the challenge of orchestrating the move. Moving 10 low-level contaminated refrigerators 30 kilometers is not easy. Pacific Northwest and Fluor Hanford coordinated radiation safety, packaging, transportation access, pick-up, and delivery schedules. It took three trips to deliver the refrigerators, at a cost of \$3,000, which amount was more than offset by the potential purchase and disposal costs.

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SRS saves dollars, reduces waste with CMC, RME 'Hot Shop'

Savannah River Site (SRS) is saving money from centralized programmatic control of contaminated as well as clean radioactive monitoring equipment (RME). SRS uses the Commodity Management Center (CMC) concept as an organizational means to centralize control and manage inventory of various types of potentially shared resources to maximize their use. The SRS Radiological Monitoring Group has applied the CMC concept to manage the administration, coordinated use, calibration, maintenance, and technical oversight of some categories of RME.

SRS has several shops for handling and maintaining clean RME, but until recently there were no shops for calibration and repair of RME contaminated with radioactive materials. Contaminated RME therefore was often disposed of as low-level radioactive waste. To remedy this situation, the Radiological Monitoring Group identified an abandoned building and cleared it of non-usable process equipment, and the Pollution Prevention Program funded the upgrades needed to make it into a "Hot Shop"—a facility for repair and calibration of contaminated RME.

The RME Hot Shop has areas designated, posted and controlled for various levels of radiological work. The shop provides a radiological hood and work benches that are maintained as Contamination Areas and which contain the tools needed to disassemble, survey, decontaminate, service, and calibrate RME. Personnel and materials moving into and out of the building are



James Howell is shown calibrating an alpha continuous air monitor at a new maintenance facility funded by the Pollution Prevention Program at the Savannah River Site.

controlled by Radiological Protection personnel.

The Hot Shop reduces radioactive waste generation and avoids the replacement cost of equipment that was previously wasted—Hot Shop maintenance of RME alone is estimated to save \$2 million per year. The Hot Shop is now being evaluated for expansion to other categories of contaminated material and test equipment, such as torque wrenches.

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NARS keeps Pu in, lets nitrate-free water out of TA-55's HNO₃ process

Foresight at Los Alamos National Laboratory's (LANL) TA-55 Plutonium Processing and Handling Facility has eliminated a nitrate-laden liquid waste stream, earning the LANL Actinide Process Chemistry Group (NMT-2) a Department of Energy (DOE) 2002 Pollution Prevention Award for "Return on Investment."

Aqueous processing of plutonium (Pu) by the nitric acid (HNO₃) anion exchange method at TA-55 began increasing during the mid-1990s, at about the same time that regulatory agencies became concerned about the negative impacts to human health and the environment of previously acceptable discharges of nitrates. NMT-2 responded by proactively promoting an integrated waste management approach to TA-55's acidic effluent, with an emphasis on source reduction.

The result: NARS, or Nitric Acid Recovery System, a distillation process that recycles the HNO₃ used at TA-55 for Pu dissolution and recovery. In the eight months following its implementation in April 2001, NARS reduced Pu-contaminated HNO₃ effluent by



Through fractional distillation, purified water is removed from the top of the NARS distillation column (foreground) and discharged, while re-concentrated nitric acid is removed from the bottom of the column and reused.

93 percent. NARS efficiencies are projected to approach 99.98 percent by April of this year.

For the past 20 years, effluent streams from TA-55, contaminated with trace amounts of Pu and other actinides, were processed in an evaporator. The distilled liquid from the evaporator, with up to 60 microcuries per liter of activity, was sent via pipeline to LANL's Radioactive Waste Treatment Facility (RWTF), where the acid was neutralized, and the remaining actinides were precipitated out. Evaporator bottoms were stabilized with cement in drums and stored for eventual shipment to DOE's Waste Isolation Pilot Plant (WIPP) in New Mexico. The neutralized effluent was discharged to the environment through an industrial outfall.

Evaporator distillate is now sent directly to TA-55's new recycle distillation unit—the heart of NARS—which recovers HNO₃ through fractional distillation, a process used to separate chemical constituents with different boiling points. Since water boils at a lower temperature than HNO₃, purified water is removed from the top of the NARS distillation column and discharged, while the re-concentrated nitric acid is removed from the bottom of the column and reused.

Not only does NARS avoid discharges of nitrates at TA-55's industrial outfall, but it recycles 100 percent of radioactivity back into the system. Likewise, procurement of the high-molarity HNO₃ needed for TA-55 acid processing operations is reduced by 80 percent, and there is a significant reduction in the number of drums of transuranic waste destined for WIPP. Overall, NARS will produce a 128 percent return on its capital costs of \$2 million.

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DOE labs help chemical companies improve processes

The chemical-processing industry is being assisted by no less than five U.S. Department of Energy (DOE) national labs and six universities to cut costs and become more energy efficient.

The overall goal is to help the industry improve its manufacturing processes, which, in turn, enables it to produce better products and use raw materials more wisely. In Dow Corning's case, that means creating ultra-pure silicon, which, among other applications, is used to make computer chips, cosmetics and caulking materials.

DOE's National Energy Technology Laboratory (NETL) and Oak Ridge National Laboratory are simulating chemically reacting fluidized beds using a computer code based on computational fluid dynamics (CFD). CFD, explains Thomas O'Brien, NETL senior

scientist, amounts to "understanding fluid behavior by applying computational solutions of the mathematical equations that govern fluid flow." Los Alamos, Sandia and the Pacific Northwest National Laboratories are using a similar approach to improve circulating fluidized-bed processes.

CFD has been used in various industries over the past 20 years. For example, automakers use the technology for designing components as different as fuel-injection systems and windshield wipers. However, those are single-phase flows, noted O'Brien. The labs have elevated CFD to a multi-phase flow that could ultimately introduce better, more energy-efficient fluidized beds.

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NREL research team increases silicon solar cell conversion efficiency

The U.S. Department of Energy's National Renewable Energy Laboratory's "amorphous silicon research team" has increased the conversion efficiency for single-junction microcrystalline silicon solar cells, fabricated entirely by hot-wire chemical vapor deposition, to 5.6 percent. This improved efficiency, attained after only four months of research, may mean hot-wire microcrystalline cells have potential for additional improvement.

Increasing the device's open circuit voltage played a major role in raising the efficiency from the previous record of 4.9 percent

efficiency. Also, lowering the deposition temperature slightly increased the amorphous fraction in the film. The deposition time for the present 0.8-micron thick cell is 18 minutes, far less than most microcrystalline deposition processes.



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Dynamic Water Budget Models could avert drought crises



Water management tools such as Sandia's Dynamic Water Budget Models might avert drought in many parts of the world, according to model co-developer Dick Thomas of Sandia National Laboratories, shown in a parched area outside Albuquerque. (Photo by Randy Montoya)

Researchers at the U.S. Department of Energy's Sandia National Laboratories have developed software that might help drought-stricken areas around the world deal with water shortages.

The computer simulations, called Dynamic Water Budget Models, predict how governmental water policies affect future water resources. The models are based on commercially available simulation software Sandia has used to study everything from summer blackouts in California to global nuclear material inventories.

Each model is a complex representation of the subtle interrela-

tionships among ground and surface water sources, recharge rates, groundwater pumping, irrigation, climate, evapotranspiration, and demographics. Future models will include other factors, such as environmental impacts, water quality, economic productivity, and an area's social and cultural foundations.

"This is the only model we've found that allows for big-picture, long-term planning," said Dick Thomas, one of the program's creators.

Sandia built the first water model in the mid 1990s to examine water trends for China's 10 major water basins, concluding that water will become a limiting factor in the country's ability to feed itself during the next two decades as China's major agricultural areas run increasingly large water deficits. The simulations were part of a Harvard University study that helped alter the way some experts now think about China's future. The team next looked at the mid-Rio Grande Basin, the primary water supply for the Albuquerque metropolitan area.

According to the National Intelligence Council's *Global Trends 2015*, half the world's population will lack access to fresh water by that year. "We must do something now to prevent water resources from instigating political instability, or prepare for the inevitability of conflict over water," added Sandia co-developer Steve Conrad. "It is in our interest to help these governments plan their own futures." The Sandia team is now exploring the possibility of modeling water issues for basins shared by countries of the former Soviet Union, for nine countries that border the Nile River, and for the U.S. and Mexico in the El Paso/Cuidad Juarez border area.

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Ozone treatment for spuds may help sanitize mail handling

The same technology that helps keep Idaho potatoes fresh for delivery to supermarkets and American kitchens may also prevent terrorism from being delivered through the U.S. mail.

Destroying anthrax using ozone is the focus of an experiment involving researchers at the U.S. Department of Energy's (DOE) Idaho National Engineering and Environmental Laboratory (INEEL) and a small Aberdeen, Idaho business, the O3Co. The company has developed a patented process to deliver high concentrations of ozone—300-800 parts per million—to freshly harvested potatoes as they travel along conveyor belts. Ozone destroys harmful bacteria such as *Erwinia*, responsible for soft rot, silver scurf, and pink rot, allowing farmers to safely store their potato crops for months. The same process may be applicable to destroying anthrax in the mail, INEEL researchers believe. Unlike chlorine dioxide, a hazardous chemical used to treat potatoes and disinfect anthrax-contaminated facilities, ozone leaves no residue and for potatoes, takes just seconds to work.

The ozone tests are just one part of the ongoing research INEEL is conducting to combat terrorism in support of DOE's national security mission. Ozone's instability causes its extra oxygen atom to want to attach to something, and carbon is its favorite something. Since viruses and bacteria such as anthrax are virtually all carbon, those extra oxygen molecules attach themselves and create carbon dioxide. This oxidation cremates the bacteria.



A view from above shows the corona discharge from an ozone generator.

"We couldn't pass up the opportunity to work with O3Co.," said Ken Watts, a manager in INEEL national security research and development. "The relationship is working so well that we're creating a CRADA (Cooperative Research and Development Agreement) to formalize it."

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LANL, Johnson Controls give Nambé Pueblo recycling a boost

Los Alamos National Laboratory's (LANL) help in organizing the nearby Nambé Pueblo Recycling Facility has been recognized by the Department of Energy (DOE) with a 2002 DOE Pollution Prevention Award for "Community Outreach and Education."

Thanks in part to Johnson Controls Northern New Mexico, LANL's recycling contractor, the Nambé Recycling Facility is now in full operation. In the mid-1990s, Nambé Pueblo began looking for alternatives to increasingly costly landfill disposal. At the same time DOE and LANL were seeking ways to build partnerships in neighboring communities.

In 1998, Nambé Pueblo Development Corp. began discussions with Johnson Controls Inc., parent company of the recycling contractor, regarding establishment of a materials recycling facility at Nambé Pueblo; now the Facility is a reality. Johnson Controls Northern New Mexico financed about \$349,000 toward the purchase of equipment and construction of the Facility and provides ongoing technical support.

Nambé Pueblo Recycling Facility currently provides collection, sorting, baling, and market identification services for recyclable materials to Los Alamos County, LANL, the City of Española, and businesses in the Tesuque and San Ildefonso Pueblos. The Facility currently processes 350 tons per year of paper products, glass, plastic (types 1 and 2), aluminum, and other scrap metals. Outside markets are being identified for other materials, including 5,000 tons per year of concrete and asphalt that is currently crushed and reused by Nambé Pueblo for paving fill.

The Facility will soon install a glass pulverizer that produces an aggregate that can be used in "glass-crete," as a reflective agent in paint for crosswalks and curbs, as a landscape ground cover, and on roads during icy conditions. Soil and organic waste will later be processed into compost and sold.

LANL's partnership in this outreach project advances the objectives of Executive Order 13101, in that the Facility acquaints local communities with the environmental and economic benefits of recycling and creates regional markets for recycled materials. The Facility has already held community meetings, participated in student recycling fairs, and conducted mass mailings to households in the area, as well as airing radio spots and placing feature articles in local newspapers. It provides eight permanent jobs, and its staff



Nambé Pueblo Recycling Facility currently processes 350 tons per year of paper products, glass, plastic, aluminum, and other scrap metals.

can earn credits in environmental management at Northern New Mexico Community College.

Through such outreach and education efforts, the Facility plans to decrease by 25 percent the solid waste sent to landfills from its service area and to become recognized as the recycling leader in Northern New Mexico. The Facility is building productive partnerships with groups such as Northern New Mexico Recycles, the New Mexico Recycling Coalition, and the Southwest Public Recycling Association to support local, statewide, and regional recycling as an attractive, affordable option to landfill disposal.

A primary Facility goal is to create a profitable business for Nambé Pueblo by 2003. Future plans include an eco-industrial park that could serve as a market for the materials processed at the Facility, a partnership with a company that uses plastics in more durable road paving materials, and expanding services into areas that lack recycling.

Nambé Pueblo is excited to be home to an industry that is consistent with tribal values and protects the environment. The Recycling Facility gives the entire region a sustainable and financially feasible way to minimize waste and a viable industry in an area that suffers from a shortage of economic opportunities.

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Savannah River, Aiken salute the flag with aluminum recycling

Celebrating America Recycles Day in November 2001, the Pollution Prevention Team from the Savannah River Site (SRS), along with the nearby City of Aiken, S.C. and various community volunteers, constructed this 55- by 104-foot replica of a U.S. flag entirely from aluminum cans. The SRS team came up with the idea to raise local awareness of recycling, and volunteers collected and constructed the flag over a two-day period.

Aiken city officials volunteered the softball complex and the City's Department of Public Safety set up a ladder-tower platform that extended 100 feet for this bird's-eye view of the completed flag replica. Approximately 80,000 red, blue and white or silver cans were used in the construction of the flag, and about 20,000 additional cans of other colors were also collected. Flag construction required approximately 16 hours of labor from 10 full-time workers and part-time help from around 70 volunteers from the community. After a patriotic ceremony, City of Aiken workers



dismantled the flag, and all the cans were sold and the proceeds sent to the New York City relief effort.

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U.S. National Nuclear Security Administration

19th Biannual Pollution Prevention Hands-on Training Technology Workshop

Charting New Courses: Environmental Strategies for a Brighter Future

San Diego workshop 'the best ever,' say participants—and it won't be the last

Everyone in attendance agreed: the National Nuclear Security Administration (NNSA) 19th Biannual Pollution Prevention Hands-On Training Technology Workshop in San Diego this past January lived up to its billing, "Charting New Courses." As workshop series originator John Marchetti of NNSA's NA-53 said in his opening remarks for the workshop's plenary session, "Things are bleaker now than they were in 1988, when we first got pollution prevention going in the Department of Energy." Making the most of now-reduced financial and human resources is critical to keeping these programs moving ahead in the right direction, he said. "Not every leader has to be a manager," he reminded workshop participants. "Leadership is getting somebody to take your idea and run with it."



Deputy Director James Mangeno:
"There's no reason EMS can't be part of ISMS."

encompasses ES&H issues, Mangeno noted, but different people place emphasis on different components of ES&H. It is his responsibility to balance these emphases within NA-53 programs. "John (Marchetti)'s program had a major reduction, but some (programs) got zeroed out. This one fared better than others."

Mangeno said that within the NNSA ES&H organization, the office "that will directly affect most people in this room" is the Office of NEPA Document Preparation and Review. "The key to success in ES&H is to make line management feel responsible for it," he told participants.

Mangeno led a discussion on the integra-

tion of environmental management systems (EMS) with ISMS. An EMS, he pointed out, helps keep a DOE facility environmentally compliant through use of pollution prevention, design for the environment, green chemistry, recycle, and other technologies, and, he added, "The key is compliance."

Mangeno, along with Marchetti, briefed the workshop on the recent site-wide implementation of ISMS at Los Alamos National Laboratory, the Y-12 National Security Complex, and Nevada Test Site. One challenge facing NNSA management is that the annual reassessment required of facilities under ISMS (which includes EMS) has been driven by queries from the Nuclear Facility Safety Board.

Referring to a recent DOE survey, workshop participant Arnie Edelman (SC-83) commented that "many responses equated ISMS to an EMS. In reality, that's not the case." Mangeno's point was that this merging of systems is still the challenge. He responded, "There's no reason EMS can't be part of ISMS . . . Where I come from in Naval Reactors, they've always been integrated . . . they should be . . . and will be (in NNSA). But the sites can work out the details themselves."

Marchetti added that in a DOE-wide EMS roundtable held in November 2000, the consensus was that EMS would enhance ISMS, and that, while ISMS was the only system needed, the environmental component in ISMS needs to stress pollution prevention rather than control and/or management of waste. After a review of the six NNSA sites with EMS implemented or in planning, Mangeno concluded that EMS will enhance ISMS, reduce environmental vulnerabilities, and free up resources for accomplishing the NNSA mission.

Joe Estey, long-time favorite workshop facilitator and management guru with Prolepsis Training, indicated to the gathering that pollution prevention is going through an "identity crisis" and suggested some ways to make it a 21st century success. Linda Giannelli Pratt with the City of



San Diego's Environmental Services Department outlined how she achieved management support to get her organization to adopt sustainable practices in its everyday operations. Some of her successes include replacing gas-guzzling sport utility vehicles with more gas-efficient station wagons, a retrofitted "green" building which saves the City \$200,000 per year in energy costs, liquid-propane powered garbage trucks on more efficient pickup routes, and a co-



generation incinerator/power plant at the municipal landfill.

Estey returned to share with the NNSA group successful sustainable technologies, such as reusable digital paper; as well as some good ideas that didn't make it, such as a robotic lawnmower powered by *e. coli* bacteria. Karin King of the DOE Oakland Operations Office made a presentation on the Federal Network for Sustainability (FNS), a consortium of U.S. government agencies primarily in the West that focuses on promoting affirmative procurement, green power usage, and EMS implementation within the national government. The FNS sponsors workshops and showcases Federal sustainability success stories via the web and its electronic newsletter. (Contact Curtis Framel, DOE, at 206-553-7841 or curtis.framel@ee.doe.gov and go to www.federalsustainability.org.)

Steve Bimson, founder and Managing Director of San Diego's Regional Transportation Center (RTC), briefed the workshop on the advantages to the environment afforded by alternative fuel vehicles (AFVs) and how they are being actively promoted in the San Diego area, particularly through the RTC. This innovative education center, Bimson said, is intended to inform the public on the benefits of AFVs and increase their acceptance. The RTC will include a showroom, rental/demonstration operation, service center, fueling station, and education center, and is projected to open in Fall 2002. Scott Shatwell, also of RTC, demonstrated two all-electric passenger vehicles and a propane-powered van for workshop participants before the lunch break. (For more information on the Regional Transportation Center, go to <http://www.rtc4afv.com/>.)

In the afternoon plenary session, Estey introduced the topic of integrating pollution prevention into ISMS by comparing a compartmentalized versus an integrated organization. A compartmentalized organization, for example, measures only throughput, while in the integrated organization, the outcome and process are emphasized. Tom Rotella (NA-53) oriented participants in the use of the NNSA Lessons Learned Program, and performed an on-line demonstration of the Lessons Learned Portal (<http://lessons-learned.net>) which will be available throughout NNSA when security checks are completed. Rotella was joined by Chris

Coccagna of SAIC to introduce workshop attendees to the DOE Occurrence Reporting Binned Information Trading Tool (ORBITT), a web-enabled database application that generates user-specified operational and trend data reports (including lessons learned, corrective actions, and occurrence reporting fields) by topic.

Coccagna then made a presentation on incorporating the requirements of Executive Order 13148 and EMS into NNSA ISMS programs. The draft NNSA implementation guide for EMS is based on ISO 14001 requirements, she noted, but most are redundant to concepts used in developing ISMS.

Marjorie Gonzalez of the Directorate of Nuclear Technology (DNT) at Lawrence Livermore National Laboratory showed the



SAIC's Chris Coccagna: NNSA's draft implementation guide for EMS is based on ISO 14001 requirements.

workshop how DNT had "cross-walked" EMS into ISMS in her organization. After getting management commitment to a full, complete, uninterrupted review of the DNT ISMS, which was already in place, DNT concluded that "they did have an 'E' in ISMS" and a separate EMS would not be needed. Estey took the floor to lead the workshop assembly in an exercise in group building, then the topic area working groups held individual sessions to prepare questions for their site visits on the following day.

On the workshop's second day, the topic groups visited six San Diego-area industries to learn how they had integrated pollution prevention and sustainability into their organizations. After the site visits, each group prepared a PowerPoint® presentation on its findings to share with the reassembled workshop on the third and final day. (See topic area group presentations at <http://www.mer-inc.com/workshops/sandiego/summary/presentations/>.)

The group presentations at the NNSA P2 workshops are always an occasion for fevered creativity in performance as well as fact-finding. The Continual Environmental Improvement Group set the

mark for the 19th Biannual gathering when Adm. Gordon "Top Gun" Langlie made a brisk entrance to stirring music before leading his group's presentation of their visit to the North

Island Naval Air Depot in San Diego harbor. It was a



DOE/EM's Gordon "Top Gun" Langlie: "You've got to clean that up!"

tough act to follow. Lisa Burns, Rich Cellamare, and Ted Doerr presented for the EMS group, who visited Kyocera Wireless Corp.'s local manufacturing plant. Mac McDougald, Monica Mace, and Bill Schlosberg talked Waste Minimization from the perspective of sports equipment manufacturer Callaway Golf. Keith Peterson and Sue Morss shared with participants the Design for Environment group's experiences at Sony Technology Center-San Diego's Rancho Bernardo facility, followed by T.J. McGeachen, Carol Laumeier, Mike Sweitzer, Julie Lyons, and Jack Mizner holding forth for the Energy Conservation group, which had visited the San Diego units of Unisys Corp. and Qualcomm.

Several of the industry tour hosts attended on the final day of the workshop. Group members were delighted at the arrival Thursday morning of Mel Barerra and Robert Espinosa of the Naval Air Depot; Geraldine Domingo, Heather Brueber, Barbara Semon, Chris Maybee, Diane Geldreich and Ken Dryden of Kyocera Wireless; and John Boothman of Unisys Corp.

After a brief review of informal photos of participants made during the workshop, Marchetti closed the 19th Biannual Pollution Prevention Workshop with a few encouraging remarks. The location and dates of the next Hands-On Training Technology Workshop will be announced sometime later in 2002.

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North Island NADEP excels in continual environmental improvement



A new NADEP ducting system for exhaust air from the plating tanks to the scrubbers eliminates the use of tunnel ventilation and wet scrubbers.

Naval Air Depot (NADEP), North Island, one of only three aerospace industrial depots in the Department of the Navy, employs over 3,000 military and civilian personnel in over 70 buildings. NADEP is thus the largest employer in San Diego that is engaged in manufacturing, maintenance, repair, modification, and painting operations for a variety of aircraft and associated systems and components. Wet process (plating and cleaning) operations are environmentally sensitive areas here since NADEP is the largest chrome electroplating facility in San Diego County.

Members of the Continual Environmental Improvement working group from the San Diego NNSA pollution prevention workshop were privileged to visit this Navy showcase facility and learn how a giant Federal site stays on the cutting edge of environmental stewardship.

NADEP chose an ISO 14001-registered Environmental Management System (EMS) "as a matter of survival," tour guide Mel Barrera told the DOE visitors. Not only does California have very strict environmental regulations, but also the municipal leaders and the many retired military residents of the City of Coronado, adjacent to the depot, are very sensitive to environmental issues.

Beginning with a gap analysis that led to top management backing for an EMS in 1997, the first four of NADEP Organizational Units became ISO 14001-certified in May 1999. NADEP accomplished ISO 14001 registration despite the limited resources and budgetary restraints ubiquitous in many pollution prevention efforts, competing plant-wide initiatives, and the problems inherent to a large organization coping with change. "The EMS is not the Environmental Program Office," stressed Barrera. Rather, it is a management system whose administration resides throughout the NADEP organization and which is executed by the seven organizational units that are currently registered to ISO14001. The effect of the management system has been to integrate pollution prevention and planning into the strategic business units.

The Environmental Program Office is responsible for the EMS monitoring and record-keeping functions specified in the ISO 14001 guidelines. This enables the EMS at all

organizational levels to focus on and enable continual environmental improvement, while it takes advantage of Department of Defense (DoD) strengths such as rigorous document control, explicit Navy guidebooks and instructions, and "all-hands" dissemination of information.

There has been a significant return-on-investment for ISO 14001 registration at NADEP. Approximately \$4,000 to \$6,000 was spent for each organizational unit audited for registration, but since ISO 14001 was implemented three years ago, there has been an overall cost avoidance of approximately \$1,000,000 from various EMS initiatives. The continual improvement process built into ISO 14001 standards promotes best business practices. Because of success like NADEP's, and in keeping with Executive Order 13148 requiring EMS implementation at all "appropriate" Federal facilities by the end of 2005, there is rising interest in ISO 14001 registration.

As part of the continual improvement process, the NADEP's pollution prevention program supports the three core values of Naval Air Systems Command Corporate Headquarters: 1) Take care of our employees; 2) Operate like a business; and 3) Delight the customer. Since 1990, they have significantly reduced their industrial waste stream generation, from 181 million gallons per year to 1.5 million gallons per year. Of the numerous awards bestowed on them because of their adoption of these values, they are proudest of the Secretary of Defense's 1997 Environmental Quality Award.

NADEP Programs for Continual Improvement

Beneficial Suggestion Program. Employees can get cash awards for suggestions leading to waste reduction and cost savings/avoidance. In addition, employees may receive cash awards of up to 1.5 percent of their annual salary for outstanding performance beneficial to the organization.

Potential Notice of Violation (PNOV) program. Rather than getting a Notice of Violation, NADEP conducts its own inspection program in order to identify potential violations of environmental regulations.

Hazardous Material Management System (HMMS). All chemicals for each work area are kept in secure areas called "Issue Centers," and every container of a chemical is bar coded. An employee must check out weighed amounts of the chemicals needed for a job at the beginning of each shift, and that same employee must return unused chemicals before the end of the shift. Chemicals are weighed again when checked back in, and exact chemical use is tracked through a database. The database tracks which employees are using the chemicals and how much of each chemical was used—MSDSs for all chemicals are filed in the database for quick access. Only amounts needed are dispensed, reducing the possibility of large quantity spills. If an employee experiences health problems, the database can print out all chemicals to which the employee was exposed.

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Sony Technology Center-San Diego: Making things 'green' in a serious way



David Russell (gesturing) of STC-SD's 32-/34-inch CRT production facility illustrates a technical point for NNSA workshop visitors.

Making things "green" is serious business with Sony Electronics, Inc. When it comes to designing products with the environment in mind, Sony aims to be the world leader. It was to examine this aspect of Sony's corporate culture that the 19th NNSA workshop's Design for Environment group visited the Sony Technology Center-San Diego (STC-SD).

One thing that the Sony hosts made clear right away to the NNSA visitors was that STC-SD's dedication to green design comes directly from top Sony management. As expressed by Dr. Teruaki Aoki, president and COO of Sony Electronics, Inc., the parent division of STC-SD, "Sony has recognized its responsibility not only to design the best electronics products in the world, but to do it in a way that has the least impact on the environment."

Horman Millan, core technology manager for Sony de Tijuana Este television manufacturing, explained to the workshop group that even though Sony's switch to lead-free (Sn-Ag-Bi-Cu and Sn-Ag-Cu) solder in its printed wiring boards has inherent technical challenges and is up to two and a half times more expensive, "The idea is to get the lead out of landfills."

One lead-free printed wiring board line is already in production at the Tijuana facility. Other soldering process improvements being implemented at the Mexican television plant include low-VOC flux and reduction of dross (a hazardous by-product) by using an inert (N_2) atmosphere.

Sony's recognition of its role as worldwide environmental steward means employees are encouraged to come up with pollution-preventing and energy-saving ideas for manufacturing. STC-SD staff engineer Brian Kim's inspiration was to use 100 percent post-consumer recycled plastic to make parts. "STC-SD uses millions of pounds of recycled resin every year in manufacturing," Kim told the NNSA visitors.

The challenge was finding a source for that much of the right type plastic (HIPS-HB). After careful research, STC-SD developed a methodology that primarily uses agricultural plastic trays like those common to nurseries and greenhouses. "Sony basically invented the market for this type of recycled plastic," STC-SD environmental manager Bob Dodds informed the workshop group. "What we've done is create another business."

David Traver, Sony Electronics director of quality engineering, related Sony's success with EPA's Energy Star® program. Sony's goal to design the most energy-efficient products in the market without

sacrificing user satisfaction, something it has achieved in most of its product lines—73 percent of Sony TVs, for example, use less than 1 watt of electricity when in standby mode. The industry average is 7.3 watts.

Sony has helped define standby power use and is working closely with the Department of Energy to support Executive Order 13221, which mandates 1-watt standby power for all electronic devices. "If you look at the data," Traver said, "consumer electronics have greatly improved in standby power in the past three years, because visible and concerned companies like Sony have taken positive action." He shared his pet peeve: "No one is addressing low-cost, low-efficiency power packs, which now consume 70 percent of standby power."

DfE group members toured STC-SD's 32-/34-inch cathode ray tube production line, which features 100 percent recycling of the CRT glass broken in manufacturing the TV tubes. Sony is the only CRT manufacturer recycling all its broken glass product. The Rancho Bernardo facility recycled over 630,000 pounds of glass in December 2001 alone. In 2001, STC-SD recycled 80 percent of the total solid waste generated on site and will exceed 90 percent in 2002. Like other Sony products, "That (32-/34-inch) model has to be an environmental champion," Dodds remarked. "It has to be a world leader (in DfE)—that comes directly from (Sony headquarters in) Tokyo."



Timothy Agnew (left), a vice-president in STC-SD Information Technologies, explains to DfE group members how VAIO computers are assembled and tested.

Sony's VAIO™ notebook and mini-tower computers are assembled at STC-SD, and the NNSA visitors got a look at the operation. All VAIO circuit boards, which are manufactured overseas, are lead-free. This state-of-the-art assembly facility keeps only four hours' worth of raw materials on site, while cardboard shipping containers are sold whole for reuse—signs at opening stations remind employees "DO NOT CUT," and clips are used to hold box flaps open. A recent redesign in the "bulk packs" for incoming VAIO components reduced the ratio of product to packaging material.

"We're surfers in California," Dodds told the workshop group at tour's end. "And Sony likes to ride the face of the wave—that's where you get the power."

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Callaway Golf hits a waste minimization hole-in-one



Waste minimization group stops outside Callaway for a group photo. (Front row, left to right) Sally Raubfogel, Dodie Haworth, Judith Nielsen; (Second row, left to right) Sarita Berry, Monica Mace, David Janke, Bill Schlosberg; (Back row, left to right) James Rose, Mac McDougald, Ron Walton, Eric Estelle

In January, 10 attendees to NNSA's 19th Biannual Pollution Prevention Hands-On Training Technology Workshop toured Callaway Golf headquarters in Carlsbad, Calif. The complex includes facilities for both the relatively new golf ball manufacturing process (since 1999) and assembly of metal woods, irons, and the recently acquired Odyssey putter series.

Hosted by Environmental and Safety Manager Eric Estelle, the workshop's Waste Minimization topic group sought insights from the company's methodologies for achieving state and Federal mandates for waste stream management; in particular, the group looked for innovative practices that exceed mere compliance and foster sustainability.

Less than 20 percent of Callaway's total waste stream management is regulated under Federal RCRA requirements, an indication of the company's overall environmental stewardship. The majority of efforts are focused on more stringent California Environmental Protection Agency (Cal/EPA) mandates, which identify additional substances used in production that exceed state Total Threshold Limit Concentrations (TTL) and Soluble Threshold Limit Concentrations (STLC).

Several zinc compounds used in producing the golf balls constitute a significant non-RCRA waste stream; besides wasted/rejected material, these compounds also recur in rinse water, sludges, filters, etc. Zinc in the cured rubber for ball cores is non-hazardous, yet rejected out-of-spec uncured material cannot be cured before disposal, as this would be considered unlicensed "hazardous waste treatment"—an irony whereby Cal/EPA policy clearly fails to allow a more effective and cost-efficient waste treatment alternative. An innovative technique is reuse of collected zinc dust to coat the ball cores en route to the curing chamber, preventing adhesion one to another. Their process also utilizes a closed loop rinse system, which isolates the zinc residues for collection.

A significant example of consumer percep-

tion effecting change in manufacturing can be seen in Callaway's previous usage of trichloroethane (TCA) solvent within club assembly. This required an ozone-depleting label on the clubs; management noted this as a negative statement to the end user, leading to replacement with an effective naphtha/alcohol solvent. Further, this solvent is stored and dispensed in spill-deterrent gimballed containers; during the assembly process, it is constantly recovered in-line and reused. Other Callaway waste minimization schemes include:

- Pallets from vendor supplies (repaired if necessary) are reused for shipping Callaway end products.
- All cardboard is recycled.
- Chemicals are purchased in bulk, simplifying container treatment.
- Rubber (before zinc is added) is recycled back through assembly process.
- Polyurethane drums (except bottoms) and metal shaft trimmings are recycled.
- Glove liners used by assembly workers are laundered and reused.

In an extended sense, the concept of "waste minimization" is promoted among the Callaway employees. A non-union facility, line workers are organized into self-managed workgroups whose representatives meet weekly with upper management; these exchanges address any ES&H concerns. Due to extremely efficient ventilation systems there is a minimal need for personal protective equipment, that used being primarily for repeated contact with solvents. An employee ideas program is in place, and any suggestion implemented involving environmental concerns doubles the financial reward. As a noteworthy aside, Callaway has also taken innovative steps in combating repetitive strain injury, including cross training for and rotation of line duties and ergonomic supports/accommodations allowing for differences in physical attributes. Work groups are rewarded with time off with pay for attaining injury-free milestones.

Callaway set a 4-year hazardous waste reduction goal of 30 percent in 1999 and seems well on the way to achieving it. As of 2001, indicators such as pounds of hazardous waste and air emission per golf club produced have plummeted. Overall since 1994, tons of solid wastes recycled have increased significantly and recycling revenue (generated and/or saved) in 2001 alone was around \$175,000.

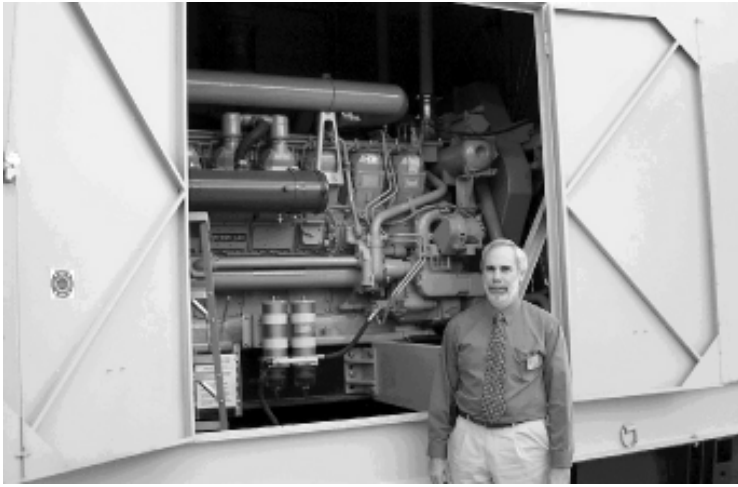
Callaway admits room for continual improvement and is actively pursuing other avenues for waste minimization or outright elimination. Perhaps the "holy grail" of golf ball manufacturing is a durable enough water-based painting process (rather than solvent-based). Other investigations include:

- a search for other manufacturers who can use some of Callaway's waste products for inclusion into their own manufacturing processes
- possible creation of an on-site solvent recycling facility
- elimination of aerosol can usage (a small but nagging RCRA-controlled volume)
- a more efficient method of use/reuse of solvent and paint wipes

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Energy Conservation 'Commandos' reconnoiter Unisys, Qualcomm sites



Tom Gordon, Engineering Manager for the Unisys Rancho Bernardo site, stands in front of a 2,000 kW standby diesel generator installed to protect the facility from rolling blackouts.

The "Elite Energy Conservation Commandos" from the 19th Biannual NNSA Pollution Prevention Technology Workshop toured two forward-thinking, high-tech companies in San Diego to investigate measures these industry leaders have taken to conserve and recover energy, prevent pollution, and decrease operating costs.

The EC Commandos' first stop was at Unisys Supply Chain Operations (SCO) located in the Rancho Bernardo Industrial Park. While at the SCO site, the Commandos learned about Unisys and how it has integrated energy efficiency into its normal business practices.

Unisys is a worldwide information technology and services solution company whose 39,000 employees help clients in more than 100 countries use technology to seize opportunities, overcome challenges and succeed in the global economy. Orders for mission-critical computers from customers the likes of NASDAQ, the Internal Revenue Service, and Carnival Cruise Lines are filled from the Rancho Bernardo location.

The EC Commandos toured the production line of Unisys' most powerful enterprise server, the ES7000, which is based on a Cellular MultiProcessing (CMP) architecture that gives a system the mainframe characteristics needed to support large-scale e-business applications and databases in Microsoft operating environments. These highly configured, unique systems are assembled, tested, and shipped within seven days, requiring Unisys to run a sleek, efficient production process. Striving for this type of efficiency pervades the SCO Rancho Bernardo facility, which is an ISO 9000:2001/1- and ISO 14001-certified operation.

From a business perspective, energy conservation has been a continuing focus for Unisys—in the past 20 years, energy use at SCO was reduced by more than 25 percent. Since the recent energy crisis in California, with its potential for both high costs and electrical blackouts, energy efficiency has taken on added importance. Among the energy conservation measures that the Commandos observed at SCO were:

- Efficient lighting. Retrofits of inefficient T-12 lamps with more efficient T-8 lamps and electronic ballasts; occupancy sensors in hallways, restrooms and office spaces.
- A dual-duct economizer system which uses either a small or

large duct based on demand.

- Variable frequency drives on all fans in the air-handling system.
- A centralized energy management system that can control and monitor 1,600 points throughout the plant.
- Cooling towers that achieve four cycles of concentration, using reject water from their reverse osmosis units, reducing the use of municipal water, and eliminating a wastewater stream typically discharged to the sewer.
- A new 800-ton, energy-efficient non-CFC chiller with variable speed drive that replaces three 20-year old CFC (R11) chillers. Due to the chiller's wide load range and high operating efficiency, it is operated almost continuously to significantly reduce the energy required for the plant's cooling load. This project has a 3-year payback and has reduced energy costs by \$84,000 per year and refrigerant maintenance costs by \$15,000 per year.
- A new 2,000 kW emergency generator system that can provide power to the entire SCO facility in case of utility power outages. The local utility also uses this generator in a program to reduce rolling blackouts throughout San Diego County.

In addition to energy conservation measures, Unisys' SCO facility also has an impressive recycling program, receiving San Diego's "Recycler of the Year" award for two years in a row. They recycle 81 percent (429 tons) of their solid waste—paper, cardboard, beverage containers, pallets, fluorescent lamps, polyurethane foam, and scrap metal—reducing annual disposal costs by nearly \$100,000.



Qualcomm host Kirk Redding beside an 800 kW gas turbine.

The second stop on the Commandos' tour was the Qualcomm San Diego Network Management Center (NMC), headquarters of the OmniTRACS™ satellite mobile communications system, which enables nationwide trucking fleets to stay in constant communication with their many different components. Qualcomm is the world's largest mobile data solutions provider, processing over 6 million messages a day through the NMC, where the staff monitors and maintains efficiency, implements new technologies, and is available 24 hours a day, seven days a week to answer customer questions.

See 'Energy Conservation' on page 15



Top management commitment is key to EMS success at Kyocera

As the Environmental Management System (EMS) topic group from the 19th NNSA pollution prevention workshop discovered, commitment from the founder of the company is key to implementing a strong EMS at Kyocera Wireless Corp. (KWC) in San Diego. Kyocera's founder and Chairman Emeritus Dr. Kazuo Inamori "believes we need to give back to the Earth," explained John Knudsen, KWC's Director of Quality Standards and leader of KWC's EMS implementation team. When asked about what drove the initial implementation of EMS and ISO 14001 independent certification at KWC, John made clear that "it was top management, including Dr. Inamori, who really cares about the environment."

Founded in February 2000, KWC designs, manufactures, and distributes wireless phones and accessories that utilize CDMA (code division multiple access) technology. KWC operates facilities in San Diego, Calif. and Boulder, Colo. The San Diego facility houses design, manufacturing and support operations with approximately 3,000 employees, while the Boulder facility for new product design is staffed with 45 employees. The San Diego facility's production capacity is currently 1.2 million wireless phones per month. Along with six other North American Kyocera companies, KWC is held by Kyocera International Inc., a division of the Kyocera Corporation headquartered in Kyoto, Japan.

KWC is ISO 9001:2000- and ISO 14001-registered. The company's internal website says that implementing an EMS "helps KWC meet regulatory requirements, it increases profits through income and cost avoidance, and it shows employees, stakeholders, and customers that KWC cares about how our business affects the environment."

KWC management principles that work in conjunction with the EMS draw upon the philosophies of the Japanese parent company. One example is KWC's "5S Principles," which are denoted by a Japanese ideogram symbolizing "the fertile soil needed to produce the tree." The 5S Principles stand for the following:

- *Sort* - Everything needed to perform the task is available.
- *Set in Order* - Everything needed is arranged and labeled for efficient access and use.
- *Shine* - Areas are "tour ready."
- *Standardize* - The task is performed in a manner that ensures consistent results.
- *Sustain* - The 5S principles are consistently applied on the job.

Graphics depicting the 5S Principles and what they mean are posted throughout the manufacturing floor. In addition, the three-part KWC environmental policy statement defines the objectives of their EMS in the very first sentence: "KWC's Environmental Management System (EMS) is committed to the prevention of pollution, protection of natural resources, waste reduction, and compliance with all applicable environmental legislation and regulations." Further, the policy states that Kyocera will strive for continual improvement by establishing environmental objectives and targets to minimize any potentially significant impacts to the environment, while promoting and maintaining the EMS culture with all employees and on-site contractors.



Considering KWC is only about two years old, their EMS is very strong and has accomplished many goals while continuing to set targets and expand the boundaries of their system. The KWC EMS structure originates



As one of KWC's five EMS Target Teams, the Utilities Team serves to monitor the company's utilities consumption, control drain discharge and promote the conservation of electricity, water, natural gas and fuel. (Left to right) Ray Deza, Suzi Thomas, Shauna McKinney, Ken Dryden (Team Leader), Jim O'Brien, Geraldine Domingo, Conrad Patterson, and John Knudsen. (Not pictured is Terry Hughes.)

with the Vice-President of Quality. Below that, there are two EMS Management Representatives who work directly with the EMS Implementation Team, which consists of an EMS Manager, an EMS Coordinator, an Environmental Health & Safety (EHS) Representative, and five EMS Target Team Leaders.

All of these team members have other primary responsibilities within KWC; EMS work is considered an extra duty for which individuals volunteer. The five EMS Target Teams focus on:

- Recycling (controlling and reducing hazardous and non-hazardous waste)
- Boulder EMS (covering environmental impact of the Kyocera design facility in Boulder, Colo.)
- Chemical Control (monitoring acquisition and use of chemicals)
- Green Manufacturing (controlling environmental impact of manufacturing)
- Utilities (monitoring/reducing electric, water, gas and fuel use)

Some of the accomplishments of these target teams include recycling an average of 63 percent of total waste generated, with a total cost savings/avoidance of \$74,049; recycling manufacturing scrap equal to 0.26 percent of production throughput; and an average monthly electricity consumption that is 6.6 percent less than FY01, saving 498,145 kWh and \$132,965.

The workshop group identified several other KWC successes directly attributable to the EMS implementation. For example, an environmental impact study is conducted for new product designs, new factory processes/equipment, and changes to existing products. 5S Principle "tours" of manufacturing areas, rather than formal inspections or audits, supplement internal ISO audits; there is an online approved chemical list with associated MSDS sheets. Employees receive cash incentives through a program paid for by the cost savings from EMS projects that they have suggested and implemented.

See 'Top Management' on page 15

From 'Top Management' on page 14

Within the past two years, KWC has received an impressive list of awards for its environmental efforts, including the State of California WRAP award, the City of San Diego Director's Recycling Award, and the EPA's Environmental Achievement Award. As part of a community outreach, KWC participated in Consumer Electronics Recycling Day at Qualcomm Stadium in San Diego.

The idea of continuous improvement is important to KWC. For 2002, KWC will be looking beyond the building envelope to their material suppliers, asking environmental questions related to EMS prior to setting up supply contracts. In addition, if KWC builds a new facility, they plan to explore green building options, utilize the Energy Star® program ideas, and possibly engage Kyocera Solar, Inc., to provide solar generating capability. KWC has done extensive analyses of energy savings opportunities within their existing building and is also a member of the EPA Climate Wise/Energy Star Program. In addition, KWC will continue to evaluate the future use of lead-free solder in their manufacturing.

The workshop visitors briefly discussed with KWC the end-of-life impacts related to wireless phones and the issues surrounding the increasing electronics waste stream. KWC continues to show environmental leadership in the wireless industry and takes an active role in reducing the end-of-life impact of wireless phones.

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From 'Energy Conservation' on page 13

Since Qualcomm's business depends on providing continual service, energy reliability is extremely high on their list. Qualcomm's energy system, which supplies electric power and climate control to the entire NMC campus, has redundancy and efficiency built in to it at every turn.

Like most area businesses, Qualcomm is grid-connected to San Diego Gas & Electric, which can provide all of the 2.4 MW of load needed for NMC operational power and climate control. But

parallel to this system, Qualcomm has three 800 kW gas turbines on-line that can provide full or partial electrical power to the facility. The turbines run on natural gas, but can be switched to jet fuel if the natural gas supply is interrupted.

The waste heat from the turbines is sent to a heat recovery unit, where the energy is removed and used to power three absorptions chillers with a hot-water loop, to meet the campus' 2,000-ton cooling capacity. Any remaining energy in this waste-heat stream is removed through a second heat exchanger to provide domestic hot water to the campus.

This combination of electrical generation and climate control is the heart of Qualcomm's co-generation (co-gen) system, which provides independence from the grid and increased efficiency. Costs for operating the co-gen plant are usually less than the purchase of utility electricity, but can vary depending on the price of natural gas. Qualcomm has the options of using completely grid-supplied power, completely co-gen power, or a combination of both.

To ensure that the OmniTRACS NMC never loses power, two additional back-up systems power their UPS (uninterruptible power supply). A battery back-up system provides a quick transition if power is lost and is backed by a 2000 kW emergency standby diesel generator.

Besides having multiple redundancy, the Qualcomm power plant is clean and efficient. Variable frequency drives are used on the chilled water pumps, cooling tower fans, and refrigerant pumps on the campus' chiller, and are planned for other applications. The entire NMC power system is managed and controlled using a Siemens Apogee™ building automation system, which can match load to need to provide optimum operating efficiency.

Contact John Boothman, Unisys Corp., 858-451-4818 or john.boothman@Unisys.com, John Morse, Qualcomm, 858-658-4028 or jmorse@qualcomm.com and T.J. McGeachen, Princeton Plasma Physics Laboratory, 609-243-2948 or tmcgeach@pppl.gov



Even antimatter gets recycled at Fermilab's Tevatron collider

Antimatter is arguably the rarest stuff Mother Nature provides here on earth. Created in high-energy particle collisions, antiparticles quickly disappear by reacting with ordinary matter. Using powerful accelerators, physicists have learned to produce and control tiny amounts of antimatter.

The yield, however, is less than a microgram per year, and antiparticles remain a precious commodity. Scientists at the U.S. Department of Energy's Fermilab—the largest known producer of antimatter (less than a microgram of antiprotons each year)—are now taking a new approach to satisfy the ever-increasing demand for antimatter: they will recycle antiprotons.

Fermilab's Antiproton Recycler Ring has stored a beam of antiprotons for more than 40 hours, circulating the beam around the 2-mile ring at nearly the speed of light. Recycled antiprotons will greatly increase the potential for particle collisions—and new discoveries—during Collider Run II of the Tevatron collider.

Contact Mike Perricone, Fermilab, 630-840-5678 or mikep@fnal.gov



Box-shaped magnets, designed to store antiprotons at close to the speed of light, sit atop the main injector of the Fermilab Recycler Ring, which accelerates protons and antiprotons from 8 GeV to 150 GeV.

ESAVE announces new triannual publication deadlines

National Nuclear Security Administration (NNSA) newsletter *ESAVE*, a publication of NA-53 at Department of Energy (DOE) Headquarters in Germantown, Md., is changing its publication dates.

The premier issue each year is now the Spring issue, released in April. A second, Summer issue will follow in August, and a third issue, Fall/Winter, will be published in December each year. The schedule has been modified due to budgetary constraints which prohibit the publication and distribution of four issues a year.

Deadlines for submitting articles to *ESAVE* will change to accommodate the new schedule. For the Spring issue, the deadline will be the last Friday in February; for the Summer issue, the last Friday in June; and for Fall/Winter, the last Friday in October.

ESAVE began as the *Pollution Prevention Advisor* in 1989. In 1993, the newsletter went to a monthly publication schedule, and became a quarterly publication in 1997. The *Advisor* changed its name to *ESAVE* in 1999 in an effort to revitalize environmental stewardship and value engineering in all operations rather than stressing only preventing pollution.



2002-2003 *ESAVE* Deadlines

Summer issue (August 2002)	Friday, June 28, 2002
Fall/Winter issue (December 2002)	Friday, Nov. 1*, 2002
Spring issue (April 2003)	Friday, Feb. 28, 2003

*nominally the last Friday in October

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or

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Phone: 828-622-9999 Fax: 828-622-9999
Email: concom@main.nc.us

Archived issues of *Pollution Prevention Advisor* & *ESAVE* are available at <http://www.mer-inc.com/newsletters/newsletters.html>

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